

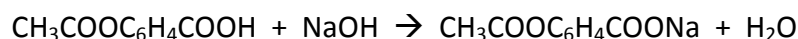
Analysis of Analgesics

Dry Lab – data will be provided

For a long time the bark of the willow tree (*Salix alba*) was used as a traditional medicine to relieve the fever symptoms of malaria. In the 1860's chemists showed that the active ingredient in willow bark was salicylic acid (2-hydroxybenzoic acid) and by 1870 salicylic acid was in wide use as a painkiller (analgesic) and fever depressant (antipyretic). However, because it is a relatively strong acid, salicylic acid has the undesirable side effect of irritating and damaging the mouth, oesophagus and stomach membranes. In 1899 the Bayer Company of Germany introduced the ethanoate ester of salicylic acid, naming it 'Aspirin'. Since that time, mild analgesics containing aspirin have appeared under many different brand names.

The aim of this experiment is to determine the percentage of aspirin present in different commercial preparations and to find which is the best value for money.

The analysis makes use of the fact that aspirin is a monoprotic acid and therefore reacts with sodium hydroxide solution according to the equation:



Procedure used: *for your information*

1. Weigh out accurately one aspirin (about 0.4 – 0.5 g) into a 50 cm³ conical flask and dissolve it in 10 cm³ of 95% ethanol.
2. Determine the pH of the resulting solution.
3. Titrate this solution with 0.1 mol dm⁻³ sodium hydroxide solution using two drops of phenolphthalein solution as indicator.
4. Repeat this procedure using an equal mass of salicylic acid.
5. Repeat this same procedure for the other tablets using a buffered aspirin, acetoaminophen and ibuprofen.

Calculations: *you decide how best to present this work.*

1. How many moles of sodium hydroxide were required to react exactly with the aspirin?
2. How many moles of aspirin were present each sample tested?
3. What is the mass of one mole of pure aspirin?
4. What is the percentage of aspirin in each sample tested?
5. What important details are missing from the tabulated data you were given?
6. Conduct the appropriate error analysis for the selected data for each sample being tested.
7. Determine which brand (excluding pure salicylic acid) had the highest purity of aspirin and therefore which is the best value for money.
8. Consider the samples that appear to have less aspirin; research what other ingredients may make up the mass and explain why they are used?
9. Why do many doctors now recommend paracetamol for headaches rather than aspirin, which is an effective mild analgesic?
10. What are the possible sources of random and systematic errors in this experiment? (Remember you have titrated aspirin this year.) What can be done to minimize the errors?